

IN THE CLAIMS:

This listing of claims will replace all prior versions, and listing, of claims in the application.

Listing of the Claims:

1. (Currently amended) A method of grading tubules in a first image of a histological slide, the method ~~having~~ comprising using computer apparatus to carry out the steps of:
 - a) providing a second image of first objects in the first image which are sufficiently large and ~~of appropriate~~ have pixel values ~~characteristics~~ at boundaries indicating epithelial layers and ~~to potentially~~ potential ~~being~~ tubules,
 - b) providing a third image of second objects in the first image having pixel values not indicating epithelial layers ~~characteristics of~~ but instead fat and holes within tubules,
 - c) combining data from the second and third images to identify as holes within tubules those selected second objects which are within first objects,
 - d) performing one or more of the following:
 - i) counting first objects in the first image which may potentially be tubules to provide a number of objects parameter,
 - ii) counting as tubules those of the first objects ~~which~~ ~~having~~ have selected second objects within them ~~and likely to be tubules~~ to provide a number of tubules parameter,
 - iii) determining the relative areas of selected second objects as proportions of respective first objects within which they are located to provide respective ratio parameters,
 - iv) determining the total area of selected second objects as a proportion of total area of first objects within which they are located to provide a surface area ratio parameter,
 - v) determining a parameter expressing the number of tubules parameter as a proportion of the number of objects parameter, and
 - vi) counting the number of first objects containing at least medium sized holes

- to provide a tubules parameter,
 - e) grading the first image's tubules on the basis of the one or more parameters as aforesaid with reference to parameter threshold values, and
 - f) using the grading of the first image's tubules to provide a tubule score for use in diagnosis.
- 2. (Previously presented) A method according to Claim 1 wherein the step of providing a second image incorporates:
 - a) thresholding the first image to provide a fourth image retaining relatively darker image pixels and rejecting relatively lighter image pixels,
 - b) inverting the fourth image to provide inverted image data,
 - c) morphologically dilating the inverted image data to provide dilated image data,
 - d) median filtering the dilated image data to provide filtered image data,
 - e) hole filling the filtered image data to provide filled image data, and
 - f) morphologically opening the filled image data.
- 3. (Previously presented) A method according to Claim 1 wherein the step of providing a third image comprises thresholding the first image to provide a binary fourth image in which relatively lighter image pixels have a different binary value to that of relatively darker image pixels.
- 4. (Previously presented) A method according to Claim 1 wherein the step of combining data from the second and third images comprises:
 - a) either multiplying each pixel in the second image by a respective corresponding pixel located in a like position in the third image, or
 - b) implementing a logical AND operation between each pixel in the second image and a respective pixel located in a like position in the third image.
- 5. (Previously presented) A method according to Claim 1 wherein the step of grading the first image's tubules employs parameter threshold values set to obtain a grading comparable with that obtainable by an appropriate medical expert.

6. (Deleted)
7. (Currently amended) Apparatus for grading tubules in a first image of a histological slide specimen, the apparatus incorporating a microscope and a camera for photographing a histopathological specimen to obtain digitised colour image data, and computer means for receiving the digitised colour image data, the computer means being programmed to:
- a) compute a second image of first objects in the first image which are sufficiently large and ~~of appropriate~~ have pixel values ~~characteristics~~ at boundaries indicating epithelial layers and ~~to potentially potential being~~ tubules,
 - b) compute a third image of second objects in the first image having pixel values not indicating epithelial layers ~~characteristics of~~ but instead fat and holes within tubules,
 - c) combine data from the second and third images to identify as holes within tubules ~~those~~ elected second objects which are within first objects,
 - d) implement one or more of the following:
 - i) counting first objects in the first image which may potentially be tubules to provide a number of objects parameter,
 - ii) counting as tubules those of the first objects which ~~having~~ have selected second objects within them ~~and likely to be tubules~~ to provide a number of tubules parameter,
 - iii) determining the relative areas of selected second objects as proportions of respective first objects within which they are located to provide ratio parameters,
 - iv) determining the total area of selected second objects as a proportion of total area of first objects within which they are located to provide a surface area ratio parameter,
 - v) determining a parameter expressing the number of tubules parameter as a proportion of the number of objects parameter, and
 - vi) counting the number of first objects containing at least medium sized holes to provide a tubules parameter,
 - e) ~~grading~~ grade the first image's tubules on the basis of the one or more parameters

as aforesaid with reference to parameter threshold values, and

- f) ~~using~~ use the grading of the first image's tubules to provide a tubule score for use in diagnosis.
8. (Previously presented) Apparatus according to Claim 7 wherein the computer means is programmed to provide a second image by:
- a) thresholding the first image to provide a fourth image retaining relatively darker image pixels and rejecting relatively lighter image pixels,
 - b) inverting the fourth image to provide inverted image data,
 - c) morphologically dilating the inverted image data to provide dilated image data,
 - d) median filtering the dilated image data to provide filtered image data,
 - e) hole filling the filtered image data to provide filled image data, and
 - f) morphologically opening the filled image data.
9. (Previously presented) Apparatus according to Claim 7 wherein the computer means is programmed to provide a third image by thresholding the first image to provide a binary fourth image in which relatively lighter image pixels have a different binary value to that of relatively darker image pixels.
10. (Previously presented) Apparatus according to Claim 7 wherein the computer means is programmed to combine data from the second and third images:
- a) either by multiplying each pixel in the second image by a respective corresponding pixel located in a like position in the third image, or
 - b) by implementing a logical AND operation between each pixel in the second image and a respective pixel located in a like position in the third image.
11. (Previously presented) Apparatus according to Claim 7 wherein the computer means is programmed to grade the first image's tubules with parameter threshold values set to obtain a grading comparable with that obtainable by an appropriate medical expert.
12. (Deleted)

13. (Currently amended) A computer software product comprising a carrier medium encoded with computer readable instructions and for use in grading tubules in a first image of a histological slide, the carrier medium not being a non-physical carrier medium, and the computer readable instructions being for controlling computer apparatus to:
- a) compute a second image of first objects in the first image which are sufficiently large and ~~of appropriate~~ have pixel values ~~characteristics~~ at boundaries indicating epithelial layers and ~~to potentially potential being~~ tubules,
 - b) compute a third image of second objects in the first image having pixel values not indicating epithelial layers ~~characteristics of~~ but instead fat and holes within tubules,
 - c) combine data from the second and third images to identify as holes within tubules ~~those~~ elected second objects which are within first objects,
 - d) implement one or more of the following:
 - i) counting first objects in the first image which may potentially be tubules to provide a number of objects parameter,
 - ii) counting as tubules those of the first objects ~~which having~~ have selected second objects within them ~~and likely to be tubules~~ to provide a number of tubules parameter,
 - iii) determining the relative areas of selected second objects as proportions of respective first objects within which they are located to provide ratio parameter,
 - iv) determining the total area of selected second objects as a proportion of total area of first objects within which they are located to provide a surface area ratio parameter,
 - v) determining a parameter expressing the number of tubules parameter as a proportion of the number of objects parameter, and
 - vi) counting the number of first objects containing at least medium sized holes to provide a tubules parameter,
 - e) grade the first image's tubules on the basis of the one or more parameters as aforesaid with reference to parameter threshold values, and
 - f) use the grading of the first image's tubules to provide a tubule score for use in

diagnosis.

14. (Previously presented) A computer software product according to Claim 13 wherein the computer readable instructions provide for controlling computer apparatus to compute a second image by:
 - a) thresholding the first image to provide a fourth image retaining relatively darker image pixels and rejecting relatively lighter image pixels,
 - b) inverting the fourth image to provide inverted image data,
 - c) morphologically dilating the inverted image data to provide dilated image data,
 - d) median filtering the dilated image data to provide filtered image data,
 - e) hole filling the filtered image data to provide filled image data, and
 - f) morphologically opening the filled image data.
15. (Previously presented) A computer software product according to Claim 13 wherein the computer readable instructions provide for controlling computer apparatus to compute a third image by thresholding the first image to provide a binary fourth image in which relatively lighter image pixels have a different binary value to that of relatively darker image pixels.
16. (Previously presented) A computer software product according to Claim 13 wherein the computer readable instructions provide for controlling computer apparatus to combine data from the second and third images:
 - a) either by multiplying each pixel in the second image by a respective corresponding pixel located in a like position in the third image, or
 - b) by implementing a logical AND operation between each pixel in the second image and a respective pixel located in a like position in the third image.
17. (Previously presented) A computer software product according to Claim 13 wherein the computer readable instructions provide for controlling computer apparatus to grade the first image's tubules with parameter threshold values set to obtain a grading comparable with that obtainable by an appropriate medical expert.

18. (Deleted)